BLEEDING TO DEATH IN ORDER TO OBTAIN MAXIMUM AMOUNT OF ANTIDIPHTHERIC SERUM FROM HORSES.*

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IT is well known that horses, injected with diphtheria toxin for the production of antitoxin, show widely different reactions. It occurs occasionally that the reaction is so severe that the death of the animal is unavoidable. It is of importance in such cases to obtain as much blood from the horse as possible before death actually takes place.

During the past two years we have had six horses react so strongly to injections of the toxin that death was imminent. The first of these was bled from the jugular vein in the usual manner and a little over two gallons of blood were obtained. The next two horses were bled from the carotid and about four gallons were obtained. Glass cannulae were used in these cases, but owing to the fall of the horses the cannulae were broken and much blood was lost. In order to avoid such accidents a structure was erected strong enough to support the weight of the horse after the latter had been suspended in a sling or the body held up by means of two stout ropes, one passing back of the forelegs, the other in front of the hind legs. The sling or the ropes are adjusted before operation is commenced and remain loose until the horse becomes weak from loss of blood. A cannula was then procured as shown in Fig. 1, about six inches long and nickel-plated. The inside measurement is $\frac{3}{8}$ of an inch, the outside $\frac{1}{2}$ an inch. The long arm, with beveled end, is inserted into the artery which has been ligatured above and held compressed by a hemostat below the incision. By such technic we obtained over five gallons of blood, the horse after a short struggle settling down into the sling.

FIG. 1.

It occurred to us that still more blood might be obtained by trans-

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fusion with salt solution. We have carried this out successfully with three horses and believe that the technic may be of use to others engaged in the production of diphtheria antitoxin.

The salt solution is placed in two 15-gallon jars, the jars being connected by a bent glass tube and supported by suitable means about four feet above the horse in order to obtain pressure by gravity. Another bent glass tube is then connected with a piece of rubber hose, the flow of the solution being controlled by an ordinary pinch cock. An incision of five to six inches is made into the neck of the horse and a nickel-plated cannula, as shown in Fig. 2, about 6 inches long, $\frac{1}{2}$ inch inside, and $\frac{5}{8}$ of an inch outside, is inserted into the jugular vein, the upper part having been ligatured, the lower part being held by a hemostat. The rubber hose from the salt solution (the solution being approximately of blood temperature) is then carefully connected with the cannula and all air is excluded. When the vein is ready, the other cannula is similarly connected with the artery. A sterile rubber hose with a small piece of glass tubing is connected with the short end of the cannula, and when everything is ready the hemostat from the artery is removed and the blood collected. As containers we have used one-gallon bottles, previously sterilized, and covered with two layers of filter paper. These layers of filter paper are tied separately, so that one may be removed without disturbing the other. Previous to filling the bottles with blood, 50 c.c. of a 10 per cent solution of potassium oxalate are measured into each gallon bottle by means of a sterile 50 c.c. pipette.

FIG. 2.

The last horse which was bled to death in the manner described yielded 54 liters of blood. Twenty gallon bottles were used, and in order to determine how much of the resulting fluid was blood and how much salt solution, we took 10 c.c. from each of the 20 bottles and put these into 20 test tubes. These tubes were kept in an ice box for three days, and after the red corpuscles had settled, percentage measurements were made. The photograph shows the gradual falling of the amount of the red corpuscles. The first three gallon bottles were filled with blood before salt solution was admitted into the body of the horse, and in these the plasma is fully two-thirds. From

the fourth bottle the fall is gradual and fairly regular. Of the 54 liters of fluid obtained, 31 were blood, and of the 36 liters plasma obtained, 21 liters were actual plasma without salt solution. We

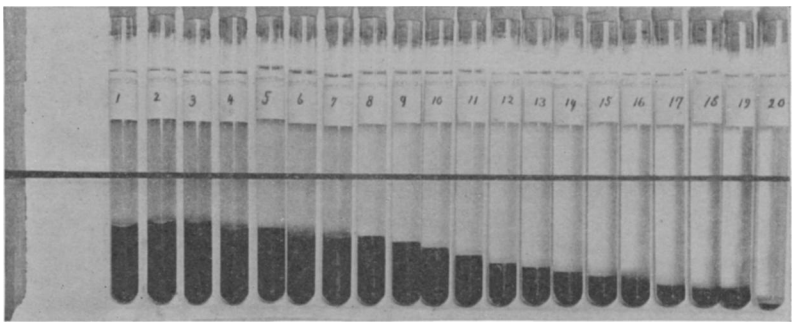

FIG. 3.

consider this a high yield, since the horse was small, weighing less than 1,000 pounds.

By applying the technic described, we have obtained an amount of blood equal to the amount usually obtained by four bleedings. It is, therefore, profitable to bleed a horse to death in this manner if conditions are such as to warrant the procedure.